MOSQUITO STUDIES (Diptera, Culicidae)

XIII. PUPAE OF THE GENUS PSOROPHORA IN NORTH AMERICA AND PUERTO RICO[1]

By

A. Ralph Barr[2]

and

Sylvia Barr

Fourteen species of *Psorophora* have been reported from America north of Mexico and Puerto Rico (Carpenter and LaCasse 1955; Stone, Knight and Starcke 1959). It is not possible at the present time to identify pupae in this genus because none has been described in detail. Neither is there a published key by which pupae of this genus may be separated from others occurring in North America. This study contains descriptions of 13 of the 14 species of *Psorophora* known from North America and Puerto Rico and discusses their identification. A generic diagnosis and discussion of generic classification is also included.

This study was made possible by the loan or donation of specimens by the following individuals: Harry D. Pratt, Alan Stone, John N. Belkin, James S. Haeger and Nina Branch, Osmun P. Breland, R.E. Bellamy, W.R. Horsfall, William Wills, and Harold C. Chapman. To all of these individuals the authors are deeply grateful.

MATERIALS AND METHODS

Pupal exuviae were mounted as described by Barr (1958). After the specimen was dissected and positioned in a small amount of thin Canada balsam, a large coverslip was placed on the exuviae and gentle but firm pressure applied to flatten the preparation. Specimens were examined with a phase contrast microscope at an appropriate magnification, usually 128 diameters, for counting branches of setae. The numbering system used for the abdominal setae was that of Barr and Myers (1962). Cephalothoracic setae were numbered in the conventional manner as illustrated in Barr (1963). The "usual" number of branches as used in this study is a restricted range which usually includes 90% or more of the observations; only unusual values

---

[1]Contribution from the Division of Infectious and Tropical Diseases, School of Public Health, UCLA, and from the project "Mosquitoes of Middle America," supported by U.S. Public Health Service Research Grant AI-04379 and U.S. Army Medical Research and Development Command Research Contract DA-49-193-MD-2478.

[2]School of Public Health, University of California, Los Angeles, California 90024.

are excluded. The widths of respiratory trumpets as given must be interpreted with care as they vary with mounting method and are not strictly comparable in various kinds of mounts.

Genus Psorophora Robineau-Desvoidy, 1827

PUPA. Very large to small. Cephalothoracic setae more or less normal for the family; 1 long; 2 usually shorter than 3; 4 and 5 well developed and subequal; 7 much longer than 6; 8 and 9 usually well developed and well separated. Respiratory trumpet about 1-1/2 to 4 times as long as its pinna. Abdomen usually without reticulation between float hairs (1) on I; float hairs usually with small number of stalks at base; 2 usually medial of 4 on I; I-6 and I-7 subequal in length, both usually branched; I-9 commonly branched; venter of I commonly with a seta. Seta 5 usually longer than, and medial of, 3 on II; 6 and 7 usually subequal in length and branched on II; venter of II commonly with a "transitory" seta. Seta 5 usually longer than, and medial of, 3 on III. Setae 1 and 5 usually well developed and subequal in length on IV and V; 4 usually longer than, and medial of, 3 on these segments. Seta 3 medial of, and occasionally longer than, 1 on VI; both usually much shorter than VI-5. Seta 6 usually smaller than, and anterior and medial of, 9 on VII. Segment VIII usually with conspicuous extensions (lobes) of the sternum and tergum which partially cover the bases of the paddles (fig.1a); seta 9 inserted on the venter slightly before the posterior corner, occasionally on the margin. IX without a seta. Paddles pear-shaped, with conspicuous midrib not reaching margin; usually without strong denticulation; accessory seta present or absent; paddle seta commonly branched.

There appears to be no single character by which the genus may be defined. The conspicuous flaps on VIII (fig.1a) have not been seen by the writers in pupae of other genera but, unfortunately, are not well developed in the subgenus *Grabhamia* (fig.2a). The position of 6 on VII (anterior of 9) is unusual although not invariable in the genus. The placement of 3, medial of 1, on VI is unusual but not unique to the genus. Another difficulty with this character is that 3 and 1 are not always readily distinguishable. If 1 is much larger than, but lateral of 3, as is usually the case, the reversal is quickly noted. If, on the other hand, 3 is as large as or larger than 1, the reversal is not apparent. These setae seem always to be reversed in *Psorophora* pupae, however, as shown by an examination of the prepupa or larva (Barr and Myers 1962) in doubtful cases. The reduction in the seta which is apparently VI-1 (actually 1 or 3) as compared with 5 is characteristic of the genus. The reduction in size of the dorsal setae on VII is also characteristic of, although not unique to, the genus.

Psorophora pupae are most likely to be confused with those of *Culiseta* or *Aedes*. Pupae of *Psorophora* have either: (1) large spines in the posterior corner of segment IV (fig.6), (2) an accessory paddle seta, or (3) prominent lobes on the posterior margins of segment VIII. These characteristics do not occur in *Aedes* or *Culiseta* pupae except that an occasional species, as *Culiseta melanura* (Coquillett) or *Aedes atropalpus* (Coquillett), may have an accessory paddle seta. The following key will aid in separating these groups.

KEY FOR SEPARATION OF PUPAE OF PSOROPHORA, CULISETA, AND AEDES

1. Posterior corner of segment IV with large spines (fig.9). . . . . .

. . . . . .*Psorophora (Janthinosoma) part*
Posterior corner of segment IV without large spines. 2

2. Posterior margin of sternum VIII with conspicuous lobes 3
Posterior margin of sternum VIII without conspicuous lobes 4

3. Accessory paddle seta present . . . . . *Psorophora (Psorophora)*
Accessory paddle seta absent . . . . . .*Psorophora (Janthinosoma) part*

4. Accessory paddle seta present 5
Accessory paddle seta absent 6

5. Either respiratory trumpet split almost completely to base, or paddle margin with large, needle-like denticles, or paddle deeply incised; 9 anterior of 6 on VII 6
Respiratory trumpet not split almost completely to base; paddle margin without large, needle-like denticles; paddle not deeply incised; 9 usually not anterior of 6 on VII . . . . . .*Psorophora (Grabhamia)*

6. Setae 1 and 5 subequal in length on IV to VI or paddle margin with long, needle-like denticles; with seta on IX; with prominent spines on hypopygium . . . . . *Culiseta*
Seta 5 usually much longer than 1 on IV to VI; paddle margin usually without long, needle-like denticles; usually without seta on IX; usually without prominent spines on hypopygium. . . . . *Aedes*

KEY TO NORTH AMERICAN PSOROPHORA PUPAE

1. Posterior corners of IV with large spines (fig.9); accessory paddle seta usually absent (*Janthinosoma*, except *cyanescens*) 2
Posterior corners of IV without large spines ventrally; accessory paddle seta usually present (except *cyanescens*), sometimes indistinct 6

2. CT-10 usually with 3 or fewer branches; II-5 usually with 4 or fewer branches; III-1 usually with 6 or fewer branches; III-5 usually with 4 or fewer branches . . . . . .*varipes*
CT-10 usually with 5 or more branches; II-5 usually with 5 or more branches; III-1 usually with 7 or more branches; III-5 usually with 6 or more branches 3

3. Heavily pigmented, grossly appears brown, not yellow; respiratory trumpets less than 3 times as long as wide; CT-12 usually with 5 or more branches; VII-1 frequently with 3 or more branches . . . . . *johnstonii*
Lightly pigmented, grossly appears yellow; respiratory trumpet 3 or more times as long as wide; CT-12 usually with 4 or fewer branches (except *horrida*); VII-1 single or double 4

4. II-1 usually with 5 or fewer branches; I-2 usually single; V-8 usually double or single; VI-11 usually single; male terminalia as in fig.6 . . . . . *longipalpus*

II-1 usually with 7 or more branches; I-2 usually with 2 or more branches; V-8 usually with 3 or more branches; VI-11 usually branched; male terminalia as in fig.5 5

5. CT-12 usually with 2 or fewer branches; I-4 usually with 4 or fewer branches; II-4 usually with 3 or fewer branches . . . . . *ferox*
CT-12 usually with 4 or more branches; I-4 usually with 5 or more branches; II-4 usually with 4 or more branches . . . . . *horrida*

6. Pupa very large; segment III as in fig.1, 4 usually closer to 5 than to 1, usually anterior of and subequal to 5 in length; II-5 and III-5 usually with 3 or fewer branches; VIII-9 usually with 5 or fewer principal branches; CT-10 usually with 4 or fewer branches; CT-8 usually single (*Psorophora*) 7
Pupa usually medium to small; segment III as in fig.2, 4 usually closer to 1 than to 5, usually posterior of and much longer than 5; II-5 and III-5 usually with 4 or more branches; VIII-9 usually with 6 or more principal branches; CT-10 usually with 5 or more branches; CT-8 usually with 2 or more branches . . 8

7. Segment VIII with dark spots anteriorly and posteriorly on either side of medial line, entire segment usually spotted; without dark medial stripe on abdomen; with diagonal stripes enclosing conspicuous light areas laterally on V to VII (fig.4) . . . . . *howardii*
Segment VIII without such dark spots anteriorly and posteriorly although usually with darker medial stripe, segment usually rather evenly dark laterally and on mid-line, with light pigmentation elsewhere; with dark medial stripe on abdomen; without pattern as described above although with diagonal stripes laterally on segments V to VII (fig.3) . . . . . *ciliata*

8. Accessory paddle seta usually absent; CT-11 usually with 3 or more branches; I-4 usually with 6 or more branches; II-4 usually with 4 or more branches; III-4 usually with 4 or more branches . . . . . *cyanescens*
Accessory paddle seta usually present; CT-11 usually single, occasionally double; I-4 usually with 4 or fewer branches; II-4 usually with 3 or fewer branches; III-4 usually single or double (*Grabhamia*) 9

9. VII-6 with 4 or fewer branches, usually double or triple; respiratory trumpet usually 2 or fewer times as long as its pinna; I-3 usually with 10 or fewer branches; V-3 with 5 or fewer branches . . . . . *insularia*
VII-6 with 6 or more branches; respiratory trumpet usually over twice as long as its pinna; I-3 usually with more than 10 branches; V-3 usually with 6 or more branches 10

10. I-5 with 4 or fewer branches; I-7 with 5 or more branches; III-6 with 3 or more branches; IV-1 with 4 or more branches; IV-6 with 3 or more branches; V-1 usually branched; V-8 with 4 or more branches; VI-6 frequently with 3 or more branches; VII-5 with 3 or more branches . . . . . *pygmaea*
I-5 with 5 or more branches; I-7 usually with 4 or fewer branches; III-6 usually double or single; IV-1 double or single; IV-6 double or single; V-1 usually single (except *discolor*); V-8 usually with 3 or fewer branches; VI-6 single or double; VII-5 usually double or single 11

11. I-4 with 4 or more branches; VII-3 usually with 4 or more branches . . . . . *signipennis*
I-4 single or double; VII-3 usually with 3 or fewer branches. 12

12. Paddle seta very long, about 1/4 or more the length of the paddle (fig.8); VII-1 usually placed about midway between lateral edge of segment and mid-line . . . . . *discolor*
Paddle seta of normal length, usually less than 1/6 the length of the paddle; VII-1 usually much closer to mid-line than to lateral edge of segment (fig.2) . . . . . *confinnis*

Subgenus Psorophora Robineau-Desvoidy, 1827

PUPA. Very large; with conspicuous dark areas, either in lines (*ciliata*) or spots (*howardii*), on various parts of the abdomen; bases of major setae usually surrounded by dark spots; setation generally short in comparison with that of the other subgenera. CT-8 usually single; CT-10 usually with 4 or fewer branches; respiratory trumpet usually less than twice as long as its pinna. II-5 usually with 3 or fewer branches. Seta 4 removed laterally, and similar to 5, on II and III; usually it is at least as close to 5 as to 1 and only slightly, if at all, posterior of 5. Usually with a "transitory" seta or at least a conspicuous sensillum on the venter of II. III-1 usually with 4 or fewer branches; III-5 usually with 3 or fewer branches. VI-3 usually smaller than VI-1 and both conspicuously smaller than VI-5. Segment VIII with conspicuous lobes on posterior margin of sternum; VIII-9 usually with 5 or fewer branches. Accessory paddle seta present although frequently indistinct; paddle usually obliquely truncate and about as wide as long.

Pupae of the subgenus *Psorophora* can usually be easily recognized by their large size, extensive pigmentation, wide paddles, presence of accessory paddle seta, presence of lobes on sternum VIII, and pattern of setation on II and III.

Psorophora (Psorophora) ciliata (Fabricius, 1794)

PUPA. Not previously described in its entirety. Partial descriptions have been given by Mitchell (1907), Howard, Dyar, and Knab (1912, 1917), Knight and Chamberlain (1948), and Lane (1953).

Very large; respiratory trumpet 1.8 to 2.1 times as long as its pinna; occasionally with a ventral seta on I. Venter of II usually with conspicuous sensilla. Paddle about 1.2 to 1.3 times as long as wide, with few, small, rounded denticles. A summary of the setal branchings is given in Table 1.

This pupa is not likely to be confused with others except *howardii.* The abdominal markings have been described by Lane (1953) and, although variable, seem invariably to be reliable for separating this pupa from that of *howardii*. The exuviae of *ciliata* grossly appear to have three longitudinal, dark lines while those of *howardii* have a mottled appearance. CT-6 may also be useful in this separation. *P. howardii* also generally has broader paddles with more and longer denticles than does *ciliata*.

Material examined: 3 specimens from Virginia, 2 from Maryland, and 1 from New York, all in the U.S. National Museum; 19 specimens from St. Paul, Minnesota in the collection of the writers.

Psorophora (Psorophora) howardii Coquillett, 1901

PUPA. Not previously described in its entirety although partial descriptions are given by Mitchell (1907) and Lane (1953). The abdominal markings have been described by Lane (1953).

Large to very large; abdomen conspicuously spotted; respiratory trumpet 1.7 to 2.0 times as long as its pinna; usually with a ventral seta on I; usually with a "transitory" seta on the venter of II; paddle 1.0 to 1.1 times as long as wide, with moderate number of small to medium, rounded denticles. A summary of the setal branchings is given in Table 1.

Material examined: 5 specimens from Louisiana, 1 each from Arkansas and Missouri, 2 from Mexico, 1 from Nicaragua, and 1 without data, all in the U.S. National Museum. Also 16 specimens from Florida in the collection of the writers, supplied by J.S. Haeger and Nina Branch.

Subgenus Janthinosoma Lynch Arribalzaga, 1891

PUPA. Usually medium or small; CT-8 usually branched; CT-10 usually with 5 or more branches (except *varipes*); respiratory trumpet about 2 to 4 times as long as its pinna. II-5 usually with 4 or more branches. Seta 4 closer to 1 than to 5 on III and frequently on II, usually markedly longer and much posterior of 5. III-1 usually with 5 or more (except *cyanescens*) and III-5 usually with 4 or more (except *varipes*) branches. All species except *cyanescens* have a patch of large, cuticular spines in the posterior corner of IV. On VI seta 3 may be larger or smaller than 1. Segment VIII with conspicuous lobes on posterior margin of sternum; VIII-9 usually with 6 or more branches. Accessory paddle seta absent. Paddle with weak denticulation.

Janthinosoma pupae (except *cyanescens*) may be easily recognized by the large spines on IV; these do not occur in other subgenera. The subgenus is also distinguished by lacking an accessory paddle seta although it occasionally occurs as an anomaly in at least *johnstonii* and *varipes*.

Psorophora (Janthinosoma) cyanescens (Coquillett, 1902)

PUPA. Previously undescribed. Medium to large; respiratory trumpet 1.7 to 2.6 times as long as its pinna; frequently with a ventral seta on I; occasionally with a "transitory" seta on II. A summary of the setal branchings is given in Table 1.

The pupa of this species has II-4 more highly branched than in other *Psorophora* species. It can be separated from *Grabhamia* and *Psorophora* by lacking the accessory paddle seta and from other Janthinosomas by lacking the prominent spines on IV.

Material examined: 10 specimens from Wilson Dam, Alabama, in the collection of J.N. Belkin (UCLA); and 11 specimens from Cameron, Louisiana, in the collection of the writers, supplied by H.C. Chapman.

Psorophora (Janthinosoma) ferox (Humboldt, 1819)

PUPA. Partially described by Mitchell (1907), Howard, Dyar, and Knab (as *sayi*; 1912, 1917) and Lane (1953).

Medium to large; respiratory trumpet 3.0 to 4.3 times as long as its pinna; frequently with a ventral seta on I; paddle with sparse, weak denticles. A summary of the setal branchings is given in Table 1.

The presence of large spines on IV marks this species as a typical *Janthinosoma*, and allies it with *horrida, longipalpus, johnstonii,* and *varipes*. It is generally markedly larger than the other four species; it also has longer respiratory trumpets and less pigmentation than *johnstonii*. The key characters given should allow the separation from *varipes* without difficulty. The pupa of *ferox* is most likely to be confused with those of *longipalpus* and especially *horrida*; the key as given serves fairly well for the specimens at hand but may require modification when additional material is examined.

Material examined: 2 specimens from Piraja, Brazil in the collection of the U.S. National Museum; 1 specimen without data in the collection of R.E. Bellamy; 9 specimens from Wilson Dam, Alabama, in the collection of J.N. Belkin (UCLA); and 4 specimens from Lufkin, Texas, collected by O.P. Breland and 26 specimens from Florida, collected by J.S. Haeger, in the collection of the writers.

Psorophora (Janthinosoma) horrida (Dyar and Knab, 1908)

PUPA. Previously undescribed; small to medium; respiratory trumpet 3.0 to 3.7 times as long as its pinna; no ventral seta on I or II in the specimens examined. Paddles with sparse, weak denticulation. A summary of the setal branchings is given in Table 1.

This pupa has CT-12, I-9, II-4, III-4, III-10, VI-4 and VI-8 uncommonly highly branched. The description is based on 15 entire pupae from Illinois reared by W.R. Horsfall. Additional characteristics may become evident when exuviae are examined.

Psorophora (Janthinosoma) longipalpus Randolph and O'Neill, 1944

PUPA. Previously undescribed; small to medium; respiratory trumpet 3.0 to 3.8 times as long as its pinna; frequently with a ventral seta on I; venter of II usually without a "transitory" seta; paddle with few, small denticles. A summary of the setal branchings is given in Table 1.

CT-10 and II-1 have fewer branches than in most species. The pupa is most likely to be confused with those of *horrida* and *ferox*. The bulbous terminalia of the male are evidenced in the pupa by the very wide basimeres.

Material examined: 12 specimens from Douglas County, Kansas, in the collection of the writers.

Psorophora (Janthinosoma) johnstonii (Grabham, 1905)

PUPA. Partially described by Thurman, Haeger, and Mulrennan (1951) and Lane (1953).

Small; with dark, rather uniform pigmentation; respiratory trumpet 2.3 to 2.8 times as long as its pinna; ventral seta frequently present on I; II frequently with "transitory" seta; paddle with very few, small denticles; accessory paddle seta occasionally present. A summary of the setal branchings is given in Table 1.

The pupa of this species is a small, dark *Janthinosoma* with short respiratory trumpets. It has CT-12 uncommonly highly branched for this group.

Material examined: 12 specimens from Florida collected by J.S. Haeger in the collection of the writers.

Psorophora (Janthinosoma) varipes (Coquillett, 1904)

PUPA. Partially described by Mitchell (1907).

Small; respiratory trumpet 2.1 to 3.9 times as long as its pinna; usually with ventral seta on I and "transitory" seta on II; paddle with medium to large denticles; accessory paddle seta occasionally present. A summary of the setal branchings is shown in Table 1.

This is a small *Janthinosoma* pupa with generally reduced setal branchings. It can be distinguished from related forms especially in the reduced branching of CT-10, I-3, I-4, I-5, II-5, III-5, V-7, and VI-6.

Material examined: 16 specimens from Wilson Dam, Alabama, in the collection of J.N. Belkin (UCLA); 1 specimen from Georgia in the collection of R.E. Bellamy.

Subgenus Grabhamia Theobald, 1903

PUPA. Usually medium to small; CT-8 usually branched; CT-10 usually with 5 or more branches; respiratory trumpet about 1-1/2 to 3 times as long as its pinna. II-5 usually with 4 or more branches. Seta 4 usually closer to 1 than to 5 on III and frequently on II, usually markedly longer and much posterior of 5. III-1 usually with 5 or more and III-5 with 4 or more branches. Seta 1 is usually larger than 3 on VI. Segment VIII without conspicuous lobes on posterior margin of sternum; VIII-9 with 6 or more branches. Accessory paddle seta present. Paddle usually with weak denticulation.

Grabhamia pupae lack the conspicuous lobes on VIII of the other two subgenera, but possess an accessory paddle seta. They are most likely to be confused with *Culiseta* and *Aedes* pupae which, however, generally lack an accessory paddle seta. In addition, Grabhamias lack the seta on IX found in *Culiseta* and occasionally in *Aedes*. The position of 6 with respect to 9 on VII is also useful in distinguishing *Grabhamia* pupae from those of *Aedes* and *Culiseta.*

Psorophora (Grabhamia) confinnis (Lynch Arribalzaga, 1891)

PUPA. Partially described by Mitchell (1907), Howard, Dyar, and Knab (as *columbiae*; 1912, 1917), and Lane (1953).

Medium to large; respiratory trumpet 1.9 to 2.8 times as long as its pinna; frequently with ventral seta on I; II occasionally with "transitory" seta; paddle with few, small denticles. A summary of the setal branchings is given in Table 1.

The pupa of this species is characterized by lacking characteristics of other *Grabhamia* pupae. Two specimens from the Virgin Islands were excluded because of the highly branched nature of CT-4, 10, 11, seta 6 on I to III and VI, IV-1, and VII-5. It is problematic whether these specimens are conspecific with the others. Three specimens from Brazil and two from Mexico agreed reasonably well with material

from the United States.

Material examined: 3 specimens from Porto Alegre, Brazil; 2 specimens from Salina Cruz, Mexico; 3 specimens from Arkansas, 2 from Louisiana, 3 from Virginia, 2 from St. Croix, Virgin Islands, and 4 without data, all in the U.S. National Museum. Also 16 specimens from Florida, collected by J.S. Haeger, and 25 from Thermal, California, collected by William Wills in the collection of the writers.

Psorophora (Grabhamia) discolor (Coquillett, 1930)

PUPA. Partially described by Mitchell (1907).

Medium size; respiratory trumpet about twice as long as its pinna; frequently with ventral seta on I; occasionally with "transitory" seta on II; paddle with few, small denticles. A summary of the setal branchings is given in Table 1.

The pupa of this species may be distinguished from those of all others in the genus by the extremely long paddle seta which is generally more than 1/4 the length of the paddle; in related species it is generally less than 1/6 the length of the paddle. In addition, setae 1 are frequently displaced laterally on V and VII. The exceptionally long paddle seta was noted by Mitchell (1907).

Material examined: 6 specimens from Eagletown, Oklahoma, and 1 without data in the collection of the U.S. National Museum; 13 specimens from Wilson Dam, Alabama, and one from Pickwick Lake, Mississippi, in the collection of J.N. Belkin (UCLA); and 3 specimens from Johnson County, Kansas, in the collection of the writers.

Psorophora (Grabhamia) signipennis (Coquillett, 1904)

PUPA. Paddle and trumpet figured by Yamaguti and LaCasse (1951).

Medium size; respiratory trumpet 1.5 to 1.7 times as long as its pinna; without a ventral seta on I or a "transitory" seta on II. Paddle with sparse, small denticles. A summary of the setal branchings is given in Table 1.

The pupa of this species is similar to most *Grabhamia* pupae except for I-4 which is exceptionally highly branched.

Material examined: 24 specimens from Poplar, Montana, in the U.S. National Museum, and 1 from Johnson County, Kansas, in the collection of the writers.

Psorophora (Grabhamia) insularia (Dyar and Knab, 1906)

PUPA. Previously undescribed; small; respiratory trumpet 1.3 to 1.9 times as long as its pinna; 2 usually lateral of 4 on I; often with a ventral seta on I and occasionally with a "transitory" seta on II; denticles on paddle medium to large, sparse to abundant. A summary of the setal branchings is given in Table 1.

This very distinct short-trumpeted pupa is characterized also by usually having 2 lateral of 4 on I, by the denticulation of the paddle, and by the small number of branches in VII-6 and I-3.

The description is based on 3 exuviae, all male, from Losey Field, Puerto Rico, December 1, 1942, in the collection of H.D. Pratt, and 3 pupae, all female, from Mona Island, Puerto Rico, collected by J. Maldonado, April 16, 1954, in the collection of the U.S. National Museum. The material from Losey Field had been identified as *pygmaea* but differed conspicuously from other material identified as that species from Cataño (see *pygmaea*). The identification as *insularia* was by comparison with Maldonado's material supplied by Alan Stone. The two lots of *insularia* also have many differences although both are clearly different from *pygmaea*; the Mona Island material has more branching in CT-6 and 9, I-5 and 6, II-4 and 6, III-4 and 8, IV-3, VII-8 and 11, and VIII-14 than does the Losey Field material. It also has longer trumpets, much less prominent denticulation and only occasionally has 2 lateral of 4 on I. It remains to be seen whether or not these two types of *insularia* are conspecific; for the present the similarities of the two justify their being considered conspecific.

Psorophora (Grabhamia) pygmaea (Theobald, 1903)

PUPA. Previously undescribed; small; respiratory trumpet 2.6 to 3.1 times as long as its pinna; usually with a ventral seta on I and occasionally with a "transitory" seta on II; paddle with small denticles laterally. A summary of the setal branchings is given in Table 1.

This pupa can be distinguished from other *Grabhamia* pupae (except *insularia*) by the small number of branches in I-5 and the large number in IV-1.

Material examined: 2 ♂♂ and 2 ♀♀ from Cataño, Puerto Rico, May 7, 1943, in the collection of H.D. Pratt.

REFERENCES CITED

Barr, A.R.
1958. The mosquitoes of Minnesota (Diptera: Culicidae: Culicinae). Minn. Univ. Agr. Exp. Sta., Tech. Bull. 228. 154 p.
1963. Pupae of the genus *Culiseta* Felt. II. Descriptions and a key to the North American species (Diptera: Culicidae). Entomol. Soc. Amer., Ann. 56:324-330.

Barr, A.R. and C.M. Myers
1962. Pupae of the genus *Culiseta* Felt. I. The homology of larval and pupal setae (Diptera: Culicidae). Entomol. Soc. Amer., Ann. 55:94-98.

Carpenter, S.J. and W.J. LaCasse
1955. Mosquitoes of North America (north of Mexico). Berkeley and Los Angeles, Univ. Calif. Press. 360 p.

Howard, L.O., H.G. Dyar and F. Knab
1912(1913). The mosquitoes of North and Central America and the West Indies. Volume II. Plates. Wash., Carnegie Inst. 150 pl. (Publication 159).
1917. The mosquitoes of North and Central America and the West Indies. Volume IV. Systematic description. Part II. Wash., Carnegie Inst. p.525-1064 (Publication 159).

Knight, K.L. and R.W. Chamberlain
1948. A new nomenclature for the chaetotaxy of the mosquito pupa, based on a comparative study of the genera (Diptera: Culicidae). Helminthol. Soc. Wash., Proc. 15:1-18.

Lane, J.
1953. Neotropical Culicidae. Vol. II. Sao Paulo, Univ. Sao Paulo. p.553-1112.
Mitchell, E.G.
1907. Mosquito Life. New York, Putnam. 281 p.
Stone, A., K.L. Knight and H. Starcke
1959. A synoptic catalog of the mosquitoes of the world (Diptera, Culicidae). Wash., Entomol. Soc. Amer. (Thomas Say Found. Publication 6). 358 p.
Thurman, E.B., J.S. Haeger and J.A. Mulrennan
1951. The taxonomy and biology of *Psorophora (Janthinosoma) johnstonii* (Grabham, 1905) (Diptera: Culicidae). Entomol. Soc. Amer., Ann. 44:144-157.
Yamaguti, S. and W.J. LaCasse
1951. Mosquito fauna of North America. Part III. Genera *Orthopodomyia, Mansonia*, and *Psorophora*. Kyoto, Honshu, Japan Logistical Command, Office Surg. 92 p.

Table 1. Usual number of branches in setae useful for identifying Psorophora pupae.

		(Psorophora)		*(Grabhamia)*					*(Janthinosoma)*					
		ciliata	*howardii*	*confinnis*	*discolor*	*signi-pennis*	*pygmaea*	*insularia*	*cyanescens*	*ferox*	*horrida*	*longi-palpus*	*john-stonii*	*varipes*
CT	- 1	1-3	1-2	1	1-2	2	1-2	2-3	2	2	2-3	2	2-3	1-2
	- 4	1-3	2-3	2-4	2-4	3-6	4-6	3-5	3-5	2-5	3-6	3-5	3-7	2-4
	- 5	1-4	2-4	3-5	3-4	4-6	4-7	3-5	2-6	2-3	2-4	2-4	3-6	2-3
	- 6	3-5	1-2	3-5	3-6	2-4	3-5	3-5	2-5	2-4	2-4	2	1-3	1-2
	- 8	1	1	1-3	2-3	2-4	2-3	3-5	3-5	2-6	3-5	2-4	3-5	1-2
	-10	1-4	2-5	4-13	5-14	9-21	10-19	9-14	4-12	5-10	4-7	4-7	7-9	2-3
	-11	1-2	1-2	1	1	1-2	1-3	1-2	2-4	1-3	2-3	2-3	1-2	1-2
	-12	2-3	1-4	1-2	2-3	3-6	2-5	3-4	3-4	2	4-8	2-4	4-9	2-3
I	- 2	1-2	1	1-4	1-4	1	1-2	2-4	1-4	2-4	2-4	1-2	1-3	1-2
	- 3	8-18	6-9	13-26	10-23	12-18	12-15	7-10	11-22	11-16	16-23	12-18	14-20	7-11
	- 4	3-6	2-3	1-2	1-2	4-5	1-2	2-4	5-11	2-4	5-8	3-5	3-6	2-3
	- 5	2-6	2-3	6-12	6-11	5-9	3-4	3-8	6-10	5-11	5-9	4-6	5-7	2-5
	- 6	3-5	2-3	2-4	2-4	3-6	4-5	3-7	3-5	2-3	2-4	2-4	3-4	1-2
	- 7	3-9	5-8	2-6	3-4	1-2	5-6	4-5	4-7	2-5	5-7	3-5	4-8	2-4
	- 9	1-4	1-2	1-4	1-3	3-7	1	1-2	1-4	1-3	3-5	1-2	1-2	1-2
II	- 1	3-10	4-8	5-13	5-11	10-15	4-11	9-16	8-18	7-13	7-14	3-5	3-9	9-14
	- 3	5-7	4-8	7-16	6-17	7-10	6-12	5-8	6-9	6-10	4-7	4-7	6-9	3-6
	- 4	1-3	2-3	1	1-2	1-3	1-2	1-4	3-7	2-3	4-8	3-5	2-4	1-4
	- 5	1-4	1-3	4-7	5-7	6-10	5-8	4-7	5-9	5-7	5-8	5-8	5-8	2-4

II	- 6	2-5	1-3	2-3	2-4	2-5	4-6	3-10	2-5	2-3	2-4	2-3	2-4	2
	- 7	4-8	3-6	3-7	2-5	4-7	5-8	3-6	4-6	2-5	3-7	3-5	4-7	2-4
III	- 1	3-4	2-3	3-8	4-8	5-11	6-13	4-7	2-5	5-10	6-12	6-10	6-15	3-6
	- 3	2-5	3-5	5-9	6-10	4-9	4-6	4-7	4-8	3-8	4-7	4-7	5-8	3-5
	- 4	2-3	1-3	1-2	1-2	1-3	1-2	1-3	3-5	1-3	3-6	2-3	1-3	1-3
	- 5	1-3	1-3	4-7	6-11	8-13	4-9	4-7	5-9	6-9	6-13	6-10	5-8	2-4
	- 6	2-6	1-3	1-2	1-2	1-3	3-4	2-4	2	2-3	2	1-2	2-3	1-2
	- 7	5-7	6-14	6-13	5-8	5-7	4-9	5-11	6-10	5-7	4-6	4-7	5-8	4-5
	-10	1-3	2-4	1-2	1-2	1-3	1-2	1-2	2-5	2-3	2-4	3-4	1-3	1-2
	-11	3-5	1-3	1-2	1-3	1	1-2	2-4	1-3	1-2	1-2	1-2	1-2	1-2
IV	- 1	2	2	1	1-2	1	4-7	2-5	1-2	2-3	2-5	2-4	3-5	1-3
	- 3	2-6	2-4	2-4	2-4	2-3	1-2	2-4	3-5	3-5	2-4	2-3	2-4	2-3
	- 4	4-6	4-8	4-12	5-10	5-10	7-9	4-9	6-10	5-9	9-13	5-10	7-12	4-7
	- 6	2-3	1-2	1-2	1-2	1-2	3-5	2-4	2	1-2	1-2	1-2	1-2	1-2
	- 7	5-7	5-8	4-9	4-7	3-5	3-5	2-6	4-8	3-5	3-6	3-5	4-6	2-4
	- 8	2-3	1-3	2-5	2-5	2-3	3-4	3-5	4-7	2-4	2-3	1-2	2-4	2-4
	-10	2-3	2-3	1-2	1	1-2	1-2	1-2	2-4	2	2-3	2-4	1-3	1-2
	-11	3-5	1-4	1-2	1-2	1	1-3	2-4	1-2	1-2	2-3	1	1	1
V	- 1	2	1-3	1	1-3	1	2-3	2-4	2	2	2	2	2-3	1-2
	- 3	4-10	4-8	5-9	6-9	6-12	5-9	3-5	5-10	6-9	7-11	5-7	6-10	5-6
	- 4	1-4	2-3	2-4	1-4	3-4	3-4	2-3	4-5	2-3	2-3	2-3	2-3	1-3
	- 6	2-3	1-2	1-2	1-2	1-2	2-4	1-2	1-2	1	1	1-2	1-2	1

Table 1 (cont.)

		(Psorophora)		*(Grabhamia)*					*(Janthinosoma)*					
		ciliata	*howardii*	*confinnis*	*discolor*	*signi-pennis*	*pygmaea*	*insularia*	*cyanescens*	*ferox*	*horrida*	*longi-palpus*	*john-stonii*	*varipes*
	- 7	5-10	4-8	5-11	5-9	5-8	4-9	3-5	6-13	6-9	6-11	6-9	7-11	3-6
	- 8	1-3	1-3	2-4	2-4	2-3	4-6	3-4	3-5	3-4	3-5	1-2	2-4	2-3
	-11	4-5	1-4	2-4	1-3	1	1-3	2-3	1-4	1-2	1-2	1	1	1
VI	- 3	3-4	2-4	2-5	1-5	1-2	2-4	2-3	1-6	2-3	2	2	1-3	1-3
	- 4	1-4	2-4	2-4	2-5	3-5	2-5	2-4	4-7	2-4	4-7	3-5	3-5	2-3
	- 6	2-3	1-2	1-2	1-2	1	2-4	1	2-3	1	1-2	2	1-2	1
	- 7	2-3	1-2	1-2	1	1-2	1-2	1-2	1-2	1-2	1-2	1	1-2	1
	- 8	2-5	2-4	3-5	3-5	2-4	4-5	2-4	4-7	2-5	4-8	2-3	2-5	1-2
	-11	2-4	1-3	2-5	3-6	2-4	2-5	2-4	2-5	1-3	1-2	1	1	1
VII	- 1	2-3	1-3	1	1-2	1-3	1-2	1-3	1-3	1-2	1-2	1-2	2-4	1-2
	- 3	2-3	1-2	2-3	2-4	3-7	2-5	2-3	3-7	2-4	3-5	3-5	2-5	2-3
	- 5	2-3	1-2	2	2-3	2-4	3-5	1-2	2-5	1-2	2	2-3	2	1-2
	- 6	5-8	5-8	7-18	8-17	7-17	7-14	2-3	11-27	5-10	9-15	5-8	6-14	3-5
	- 7	1-2	1	1-2	1	1-2	1	1	2-3	1-2	1-2	1-2	1-3	1-2
	- 8	6-12	5-11	3-10	5-10	5-11	3-8	2-5	7-19	3-7	5-10	3-5	4-8	3-4
	- 9	4-7	2-4	4-9	4-7	4-9	4-7	2-5	5-12	2-3	2-4	3-4	2-5	1-3
	-10	1-2	1	1	1	1	1	1	1-3	2	1-3	1-2	1-2	1-2
	-11	1-2	1-2	2-4	2-4	1-3	1-4	1-2	2-4	2-3	2-3	2	1-3	1
VIII	- 9	2-5	3-5	6-10	7-12	7-10	6-9	6-11	6-12	6-9	6-13	6-8	7-10	5-7

FIGURES

Fig.1. *Psorophora (P.) howardii*; metanotum and abdomen.
Fig.2. *Psorophora (G.) confinnis*; metanotum and abdomen.
Fig.3. *Psorophora (P.) ciliata*; pigmentation pattern of metanotum and abdomen.
Fig.4. *Psorophora (P.) howardii*; pigmentation pattern of metanotum and abdomen.
Fig.5. *Psorophora (J.) cyanescens*; metanotum and abdomen.
Fig.6. *Psorophora (J.) longipalpus*; metanotum and abdomen.
Fig.7. *Psorophora (J.) cyanescens*; cephalothoracic setae.
Fig.8. *Psorophora (G.) discolor*; paddle.
Fig.9. *Psorophora (J.) longipalpus*; posterior corner of segment IV.
Fig.10. *Psorophora (G.) insularia*; setae of segment I.
Fig.11. *Psorophora (G.) pygmaea*; setae of segment I.

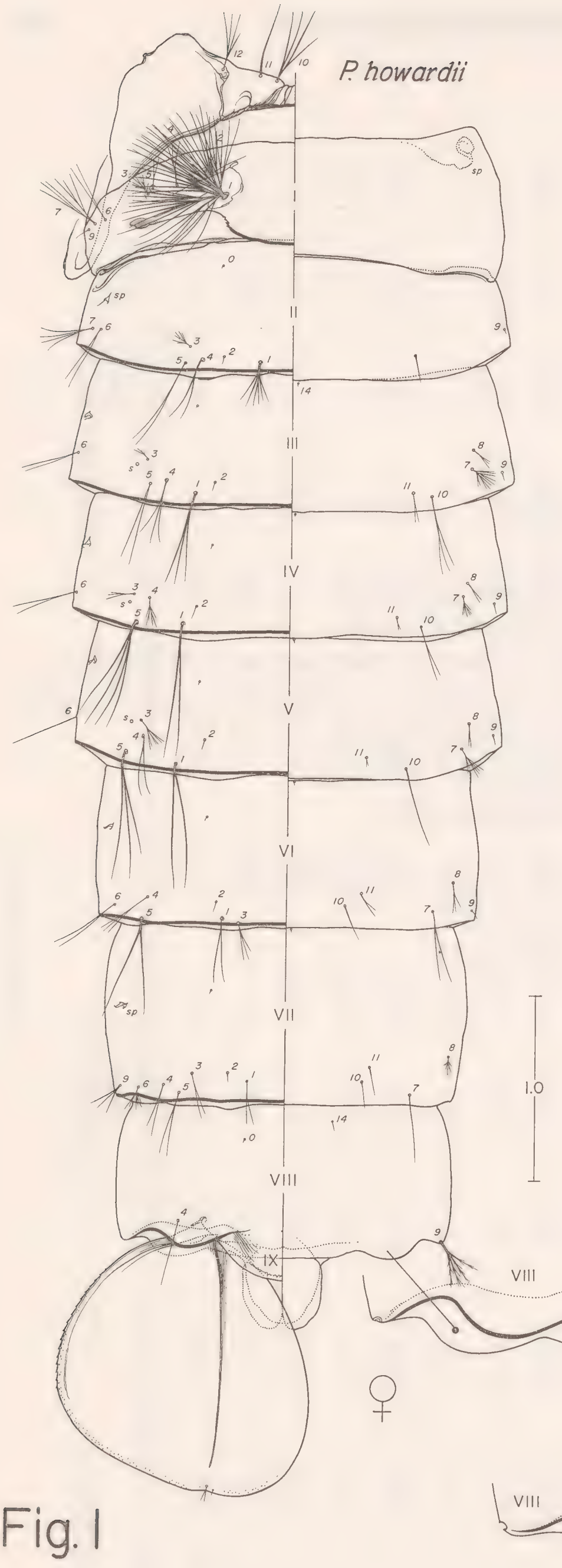


Fig. 1

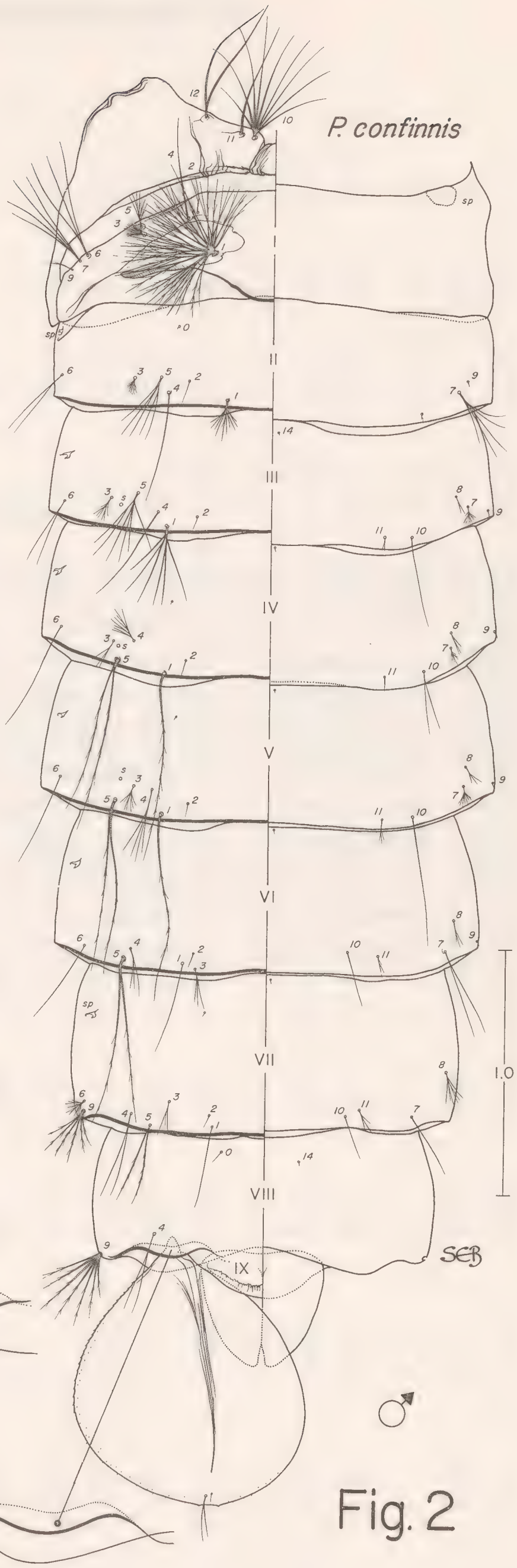
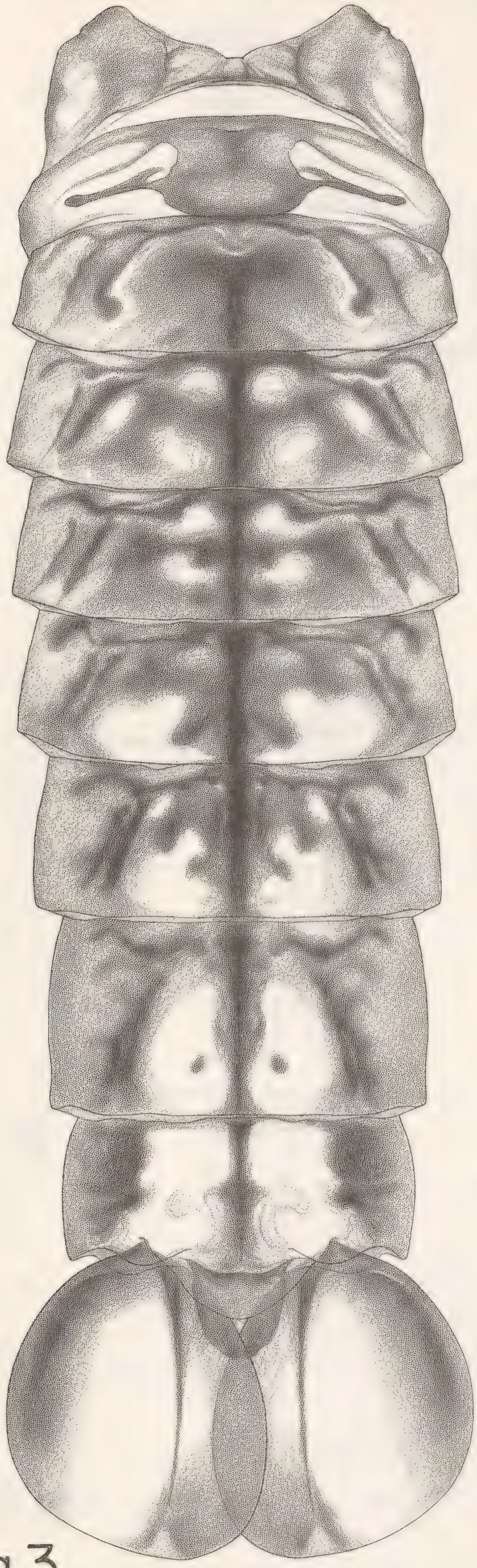


Fig. 2

P. ciliata



P. howardii

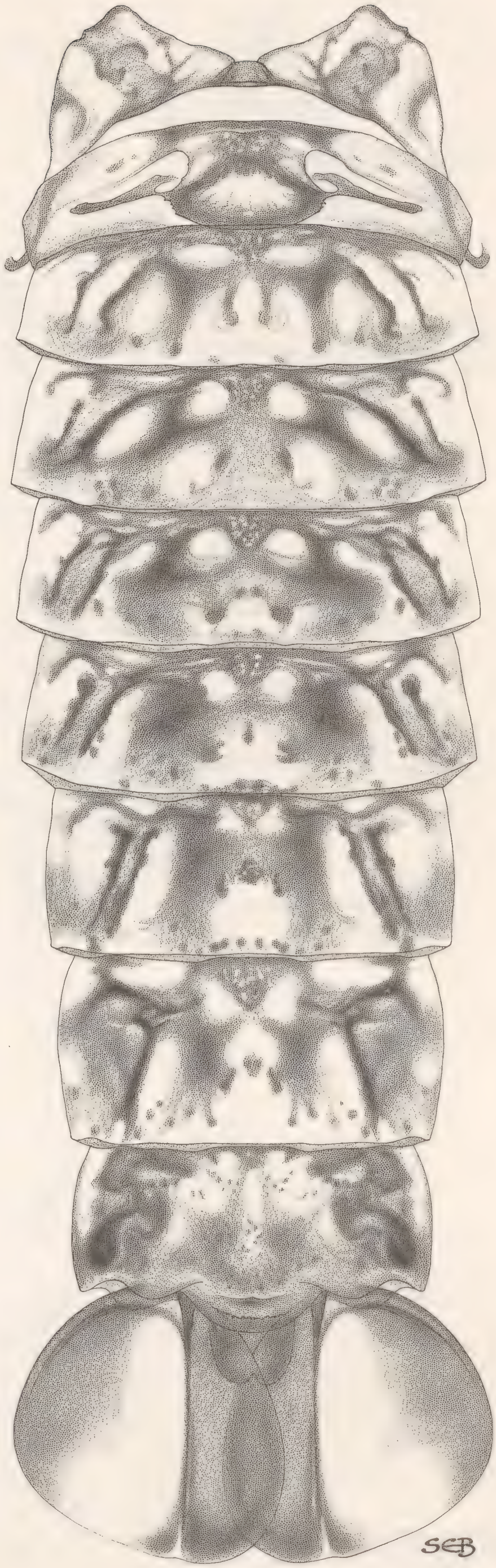


Fig. 3

Fig. 4

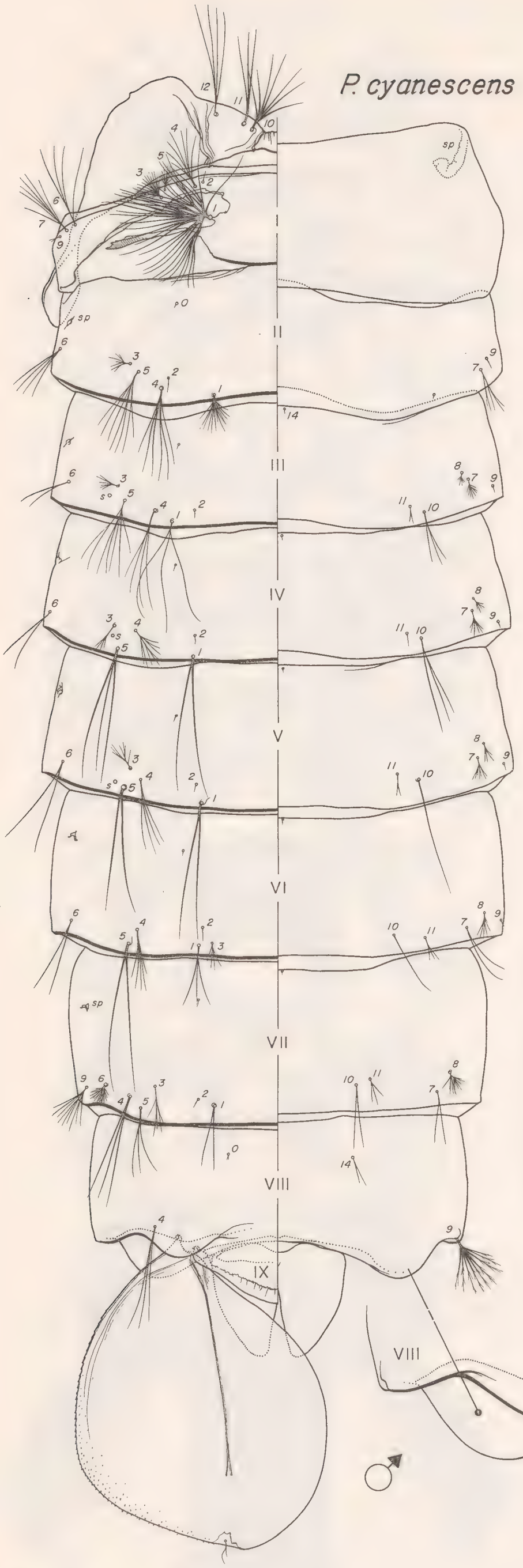

P. cyanescens
sp
II
III
IV
V
VI
VII
VIII
IX
1.0

Fig. 5

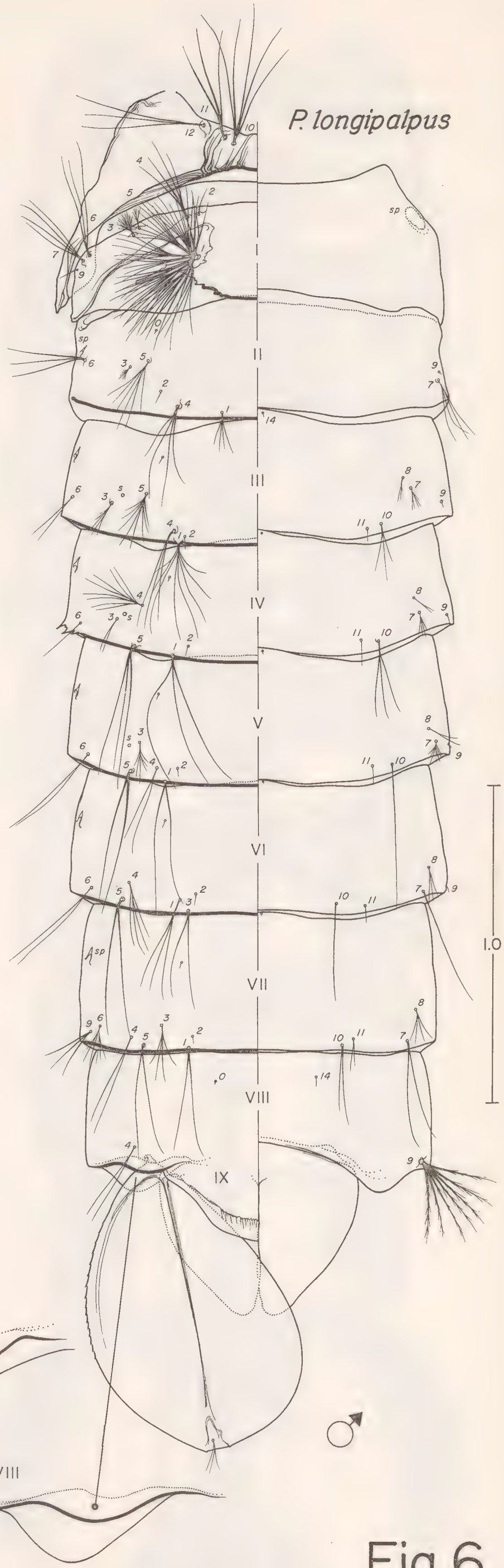
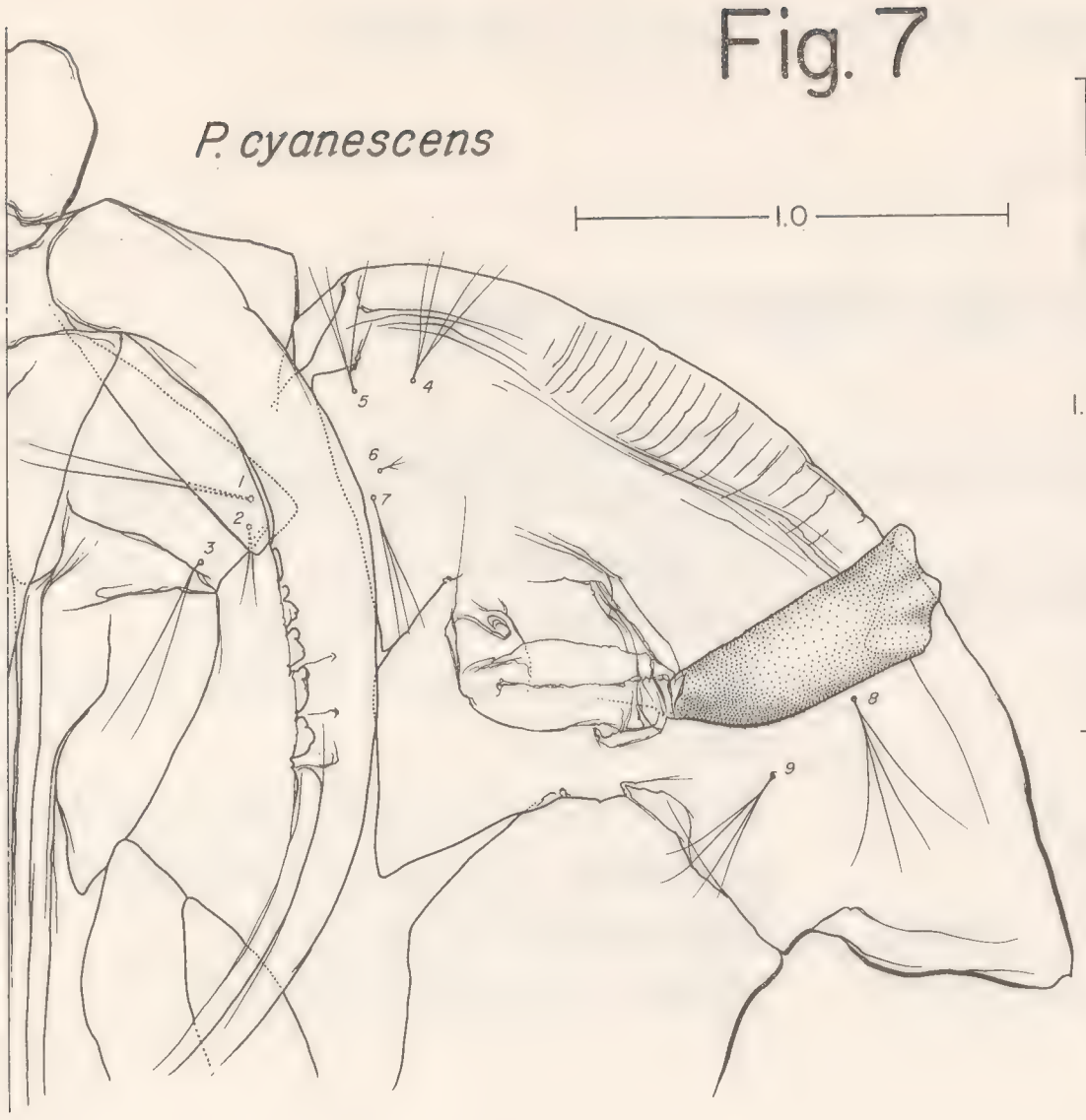

P. longipalpus
sp
II
III
IV
V
VI
VII
VIII
IX
1.0

Fig. 6

Fig. 7



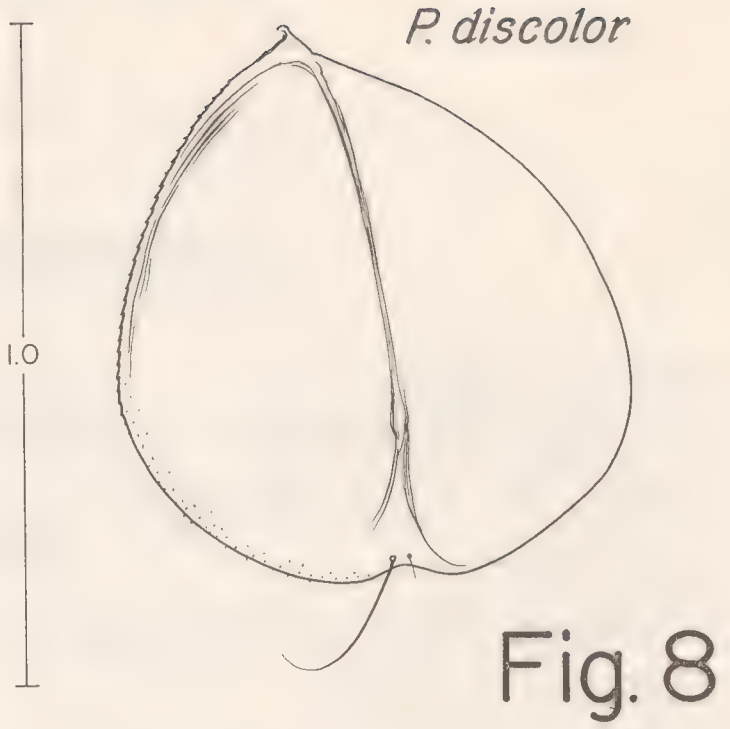


Fig. 8

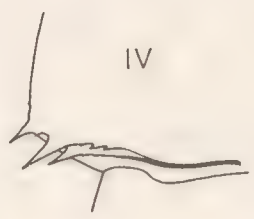


Fig. 9

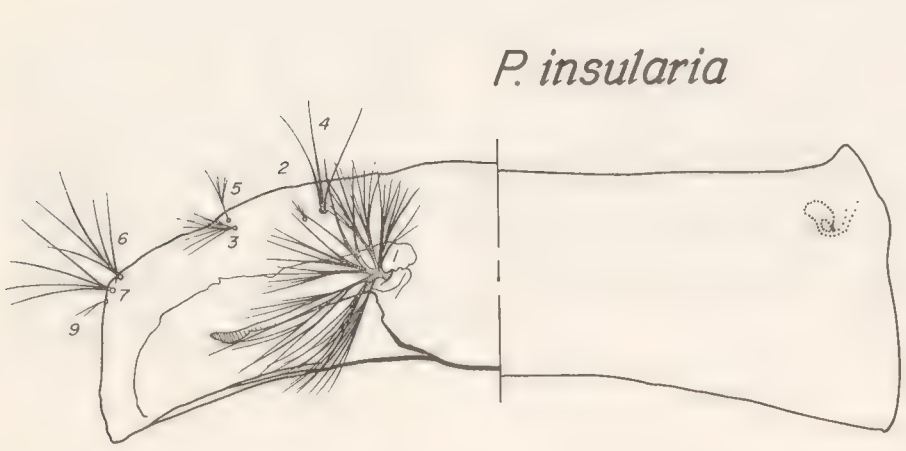


Fig. 10

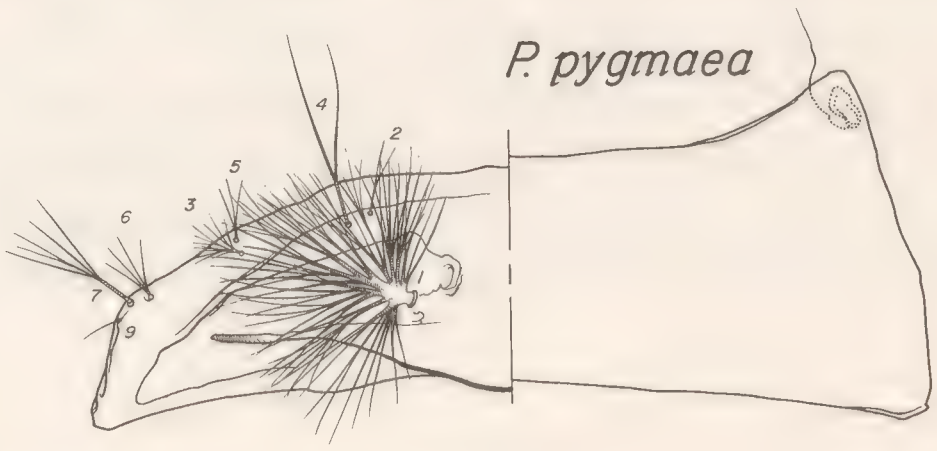


Fig. 11

INDEX TO SCIENTIFIC NAMES